Homework 1

EECS 270 Winter 2020

Due Friday, January 24 @ **11:59 PM** on Gradescope

This is an individual assignment, all of the work should be your own.
Write neatly or type and show all your work for full credit.
Have your name and unique name on the front page of your submission.

1. **[20 points]** Convert the following decimal numbers to binary, and then to octal and hexadecimal. If the fraction requires more than 6 bits, truncate the fraction to 6 bits.

   a. 128

   b. 42555

   c. 681.875

   d. 13.37

   e. 808354.808354

2. **[16 points]** Convert the following binary numbers to decimal, octal, and hexadecimal.

   a. 1010

   b. 11101

   c. 100.11

   d. 10101111.0011

3. **[12 points]** Convert the following hexadecimal numbers to decimal, binary, and octal.

   a. DA

   b. C4.E

   c. 42.58

4. **[8 points]** Your coworker has handed you a binary dump of a file. The numbers on the left of the pipes indicate which position the left-most 8-bit datum on the row is, 0-indexed (e.g. on the top row, 01001000 is at position 0 and 00101100 is at position 3). Convert the 8-bit data into ASCII text (you should get actual words; write "NUL" when you encounter a 00000000):

```
0  | 01001000 01100101 01111001 00101100
4  | 00100000 01001001 00100000 01110100
8  | 01101000 01101001 01101110 01101011
12 | 00100000 01000101 01000101 01000011
16 | 01010011 00100000 00110010 00110111
20 | 00110000 00100000 01101001 01110011
24 | 00100000 01000110 01010101 01001110
28 | 00100001 00000000
```

5. **[8 points]** Assume that a signal is encoded using 12 bits. Assume that many of the encodings turn out to be either 000000000000, 000001100000, or 111111111111. We thus decide to create compressed encodings by representing 000000000000 as 00, 000001100000 as 01, and 111111111111 as 10. 11 means that an uncompressed encoding follows. Using this encoding scheme, decompress the following encoded stream. Have a noticeable separator for each of the 12 bit signals:

   00 00 10 11 000000000001 01 11 101100111001 00 10

6. **[20 points]** Determine the number of digits necessary to represent the following decimal numbers in binary, octal, decimal, and hexadecimal representations. For example, decimal 12 requires 4 digits in binary (1100), 2 digits in octal (14), 2 digits in decimal (12), and one digit in hexadecimal (C).

	binary	octal	decimal	hexadecimal
a. 05	3	1	1	1
b. 46	6	2	2	2
c. 256	9	3	3	3

bit n $2^n - 1$

binary , octal , decimal hexadecimal

d. 5,912

e. 65,537

7. **[16 points]** Determine the decimal number ranges that can be represented in d digits for binary, octal, decimal, and hexadecimal numbers. For example, for $d = 3$, the binary range is [000, 111] which is [0, 7] in decimal. Similarly, the 3-digit hexadecimal range is [000, FFF] which is [0, 4095] in decimal.

   a. 1

   b. 2

   c. 4

   d. 8